

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 Claim 1 (previously presented): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system including at least two adjacent base  
5 stations, each one of the adjacent base stations  
6 transmitting pilot tones according to one of a plurality of  
7 different pilot tone hopping sequences over at least a  
8 portion of a pilot sequence transmission time period, said  
9 portion including multiple symbol time periods, at least  
10 one of the different pilot tone hopping sequences including  
11 at least two pilot tones per symbol time period which are  
12 separated from one another by at least one tone during said  
13 portion of said pilot sequence transmission time period, in  
14 each of the different pilot tone hopping sequences the  
15 number of pilot tones used in each successive symbol time  
16 periods in said portion of said pilot sequence transmission  
17 period being the same but the tones used in a symbol time  
18 period by any one of the different pilot tone hopping  
19 sequences changing in frequency from one symbol time period  
20 to the next symbol time period by a frequency shift  
21 corresponding to a fixed number of tones, adjacent base  
22 stations using different frequency shifts to generate pilot  
23 tone hopping sequences with different pilot tone slopes  
24 which can be determined from the frequency shift of the  
25 pilot tones used in consecutive symbol time periods, the  
26 apparatus comprising:  
27       a receiver for receiving one or more of said plurality  
28       of different pilot tone hopping sequences having different  
29       pilot tone slopes; and

30 a detector, responsive to said one or more received  
31 pilot tone hopping sequences, said detector including an  
32 energy accumulator for generating an accumulated energy  
33 measurement for each individual one of the plurality of  
34 pilot tone hopping sequences having different slopes over a  
35 period including multiple symbol time periods, said  
36 detector detecting a received pilot tone hopping sequence  
37 having the maximum accumulated energy over said period  
38 including multiple symbol time periods.

1 Claim 2 (previously presented): The invention as defined  
2 in claim 1 wherein each of said one or more received pilot  
3 tone hopping sequences is a Latin Squares based pilot tone  
4 hopping sequence.

1 Claim 3 (previously presented): The invention as defined  
2 in claim 1 wherein said receiver yields a baseband version  
3 of a received signal and further includes a unit for  
4 generating a fast Fourier transform version of said  
5 baseband signal, and wherein said detector is supplied with  
6 said fast Fourier transform version of said baseband signal  
7 to detect, based on accumulated energy measurements, the  
8 received pilot tone sequence having the maximum accumulated  
9 energy.

1 Claim 4 (original): The invention as defined in claim 3  
2 wherein said receiver further includes a quantizer for  
3 quantizing the results of said fast Fourier transform.

1 Claim 5 (original): The invention as defined in claim 3  
2 wherein said detector is a maximum energy detector.

1 Claim 6 (previously presented): The invention as defined  
2 in claim 5, wherein different initial frequency shifts are  
3 possible for different pilot tone hopping sequences having  
4 the same slope; and wherein said maximum energy detector  
5 determines a slope and an initial frequency shift for pilot  
6 tones in the detected pilot tone hopping sequence having  
7 the maximum accumulated energy.

1 Claim 7 (previously presented): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising:

5 a receiver for receiving one or more pilot tone  
6 hopping sequences each including pilot tones, said pilot  
7 tones each being generated at a prescribed frequency and  
8 time instants in a prescribed time-frequency grid; and  
9 a maximum energy detector, responsive to said one or  
10 more received pilot tone hopping sequences, for detecting  
11 the received pilot tone hopping sequence having the  
12 strongest power,

13 said maximum energy detector including a slope-shift  
14 accumulator for accumulating energy along each possible  
15 slope and initial frequency shift of said one or more  
16 received pilot tone hopping sequences and generating an  
17 accumulated energy signal, a frequency shift accumulator  
18 supplied with said accumulated energy signal for  
19 accumulating energy along pilot frequency shifts of said  
20 one or more received pilot tone hopping sequences, and a  
21 maximum detector supplied with an output from said  
22 frequency shift accumulator for estimating a slope and  
23 initial frequency shift of the strongest received pilot

24 tone hopping sequence as a slope and initial frequency  
25 shift corresponding to the strongest accumulated energy.

1 Claim 8 (original): The invention as defined in claim 7  
2 wherein said accumulated energy is represented by the

3 signal  $J_0(s, b_0)$ , where  $J_0(s, b_0) = \sum_{t=0}^{N_{sp}-1} |Y(t, st + b_0 \pmod{N})|^2$ , and  $s$  is  
4 the slope of the pilot signal,  $b_0$  is an initial frequency  
5 shift of the pilot signal,  $Y(t, n)$  is the fast Fourier  
6 transform data,  $t = 0, \dots, N_{sp}-1$ ,  $n = st + b_0 \pmod{N}$ , and  $n =$   
7  $0, \dots, N-1$ .

1 Claim 9 (original): The invention as defined in claim 7  
2 wherein said frequency shift accumulator  
3 accumulates energy along pilot frequency shifts of said one  
4 or more received pilot tone hopping sequences in accordance

5 with  $J(s, b_0) = \sum_{j=1}^{N_p} J_0(s, b_0 + n_j)$ , where  $s$  is the slope of the pilot  
6 signal,  $b_0$  is an initial frequency shift of the pilot signal  
7 and  $n_j$  are frequency offsets.

1 Claim 10 (original): The invention as defined in claim 7  
2 wherein said maximum detector estimates said slope and  
3 initial frequency shift of the strongest received pilot  
4 tone hopping sequence in accordance with  $\hat{s}, \hat{b}_0 = \underset{s, b_0}{\operatorname{arg\,max}} J(s, b_0)$ ,

5 where  $\hat{s}$  is the estimate of the slope,  $\hat{b}_0$  is the estimate of  
6 the initial frequency shift, and where the maximum is taken  
7 over  $s \in S$  and  $b_0 = 0, \dots, N-1$ .

1 Claim 11 (previously presented): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising:

5 a receiver for receiving one or more pilot tone  
6 hopping sequences each including pilot tones, said pilot  
7 tones each being generated at a prescribed frequency and  
8 time instants in a prescribed time-frequency grid; and

9 a maximum energy detector, responsive to said one or  
10 more received pilot tone hopping sequences, for detecting  
11 the received pilot tone hopping sequence having the  
12 strongest power, said maximum energy detector including a  
13 frequency shift detector for estimating at a given time  
14 frequency shift of the received pilot tone hopping sequence  
15 having strongest energy and an estimated maximum energy  
16 value, and a slope and frequency shift solver, responsive  
17 to said estimated frequency shift and said estimated  
18 maximum energy value, for generating estimates of an  
19 estimated slope and an estimated initial frequency shift of  
20 the strongest received pilot signal.

1 Claim 12 (original): The invention as defined in claim 11  
2 wherein said estimated frequency shift at time  $t$  is  
3 obtained in accordance with  $n(t) = st + b_0 \pmod{N}$ , where  $s$  is the  
4 pilot signal slope,  $t$  is a symbol time and  $n(t)$  is a  
5 frequency shift estimate.

1 Claim 13 (original): The invention as defined in claim 12  
2 wherein said estimated maximum energy value is obtained in  
3 accordance with  $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$ , where  $E(t)$

4 is the maximum energy value,  $Y(t, n)$  is the fast Fourier  
5 transform data,  $j = 1, \dots, N_p$  and  $n_j$  are frequency offsets.

1 Claim 14 (original): The invention as defined in claim 13  
2 wherein said slope is estimated in accordance with

3 
$$\hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t) - n(t-1) = s\}},$$
 where both  $n(t)$  and  $n(t-1)$   
4 satisfy  $n(t) = st + b_0 \pmod{N}.$

1 Claim 15 (original): The invention as defined in claim 13  
2 wherein said frequency shift is estimated in accordance

3 with  $\hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_n-1} E(t) \mathbf{1}_{\{n(t) = st + b_0\}}.$

1 Claim 16 (original): The invention as defined in claim 11  
2 wherein said maximum energy detector detects said slope in  
3 accordance with determining the time,  $t_0 \in T$ , and slope,  $s_0 \in S$ ,  
4 such that the set of times  $t$  on the line  $n(t) = n(t_0) + s_0(t - t_0)$ ,  
5 has the largest total pilot signal energy.

1 Claim 17 (previously presented): A method for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system including at least two adjacent base  
5 stations, each one of the adjacent base stations  
6 transmitting pilot tones according to one of a plurality of  
7 different pilot tone hopping sequences, in each of the  
8 different pilot tone hopping sequences over at least a  
9 portion of a pilot sequence transmission time period, said  
10 portion including multiple symbol time periods, the number

11 of pilot tones used in each successive symbol time period  
12 in said portion of said pilot sequence transmission time  
13 period being the same but the tones used in a symbol time  
14 period by any one of the different pilot tone hopping  
15 sequences changing in frequency from one symbol time period  
16 to the next symbol time period by a frequency shift  
17 corresponding to a fixed number of tones, adjacent base  
18 stations using different frequency shifts to generate pilot  
19 tone hopping sequences with different pilot tone slopes  
20 which can be determined from the frequency shift of the  
21 pilot tones used in consecutive symbol time periods, the  
22 method comprising the steps of:

23 receiving one or more of said plurality of different  
24 pilot tone hopping sequences having different pilot tone  
25 hopping slopes; and

26 in response to said one or more received pilot tone  
27 hopping sequences:

28 generating an accumulated energy measurement for each  
29 individual one of the plurality of pilot tone hopping  
30 sequences having different pilot tone hopping slopes over a  
31 period including multiple symbol time periods; and

32 detecting a received pilot tone hopping sequence  
33 having the maximum accumulated energy over said period  
34 including multiple symbol time periods.

1 Claim 18 (previously presented): The method as defined in  
2 claim 17 wherein each of said one or more received pilot  
3 tone hopping sequences is a Latin Squares based pilot tone  
4 hopping sequence.

1 Claim 19 (previously presented): The method as defined in  
2 claim 17 wherein said step of receiving yields a baseband

3 version of a received signal and further including a step  
4 of generating a fast Fourier transform version of said  
5 baseband signal, and wherein said step of detecting is  
6 responsive to said fast Fourier transform version of said  
7 baseband signal for detecting the received pilot tone  
8 sequence having the maximum accumulated energy.

1 Claim 20 (original): The method as defined in claim 19  
2 wherein said step of receiving further includes a step of  
3 quantizing the results of said fast Fourier transform.

1 Claim 21 (original): The method as defined in claim 19  
2 wherein said step of detecting detects a maximum energy.

1 Claim 22 (previously presented): The method as defined in  
2 claim 21 wherein said step of detecting said maximum energy  
3 includes a step of determining a slope and initial  
4 frequency shift of pilot tones in a detected pilot tone  
5 hopping sequence having the maximum accumulated energy.

1 Claim 23 (previously presented): A method for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising the steps of:

5 receiving one or more pilot tone hopping sequences  
6 each including pilot tones, said pilot tones each being  
7 generated at a prescribed frequency and time instants in a  
8 prescribed time-frequency grid; and

9 in response to said one or more received pilot tone  
10 hopping sequences, detecting the received pilot tone  
11 hopping sequence having the maximum energy, said step of  
12 detecting said maximum energy including the steps of

13 accumulating energy along each possible slope and initial  
14 frequency shift of said one or more received pilot tone  
15 hopping sequences and generating an accumulated energy  
16 signal, in response to said accumulated energy signal,  
17 accumulating energy along pilot frequency shifts of said  
18 one or more received pilot tone hopping sequences, and in  
19 response to an output from said step of frequency shift  
20 accumulating, estimating a slope and initial frequency  
21 shift of the strongest received pilot tone hopping sequence  
22 as a slope and initial frequency shift corresponding to the  
23 strongest accumulated energy.

1 Claim 24 (original): The method as defined in claim 23  
2 wherein said accumulated energy is represented by the

3 signal  $J_0(s, b_0)$ , where  $J_0(s, b_0) = \sum_{t=0}^{N_y-1} |Y(t, st + b_0 \pmod{N})|^2$ , and  $s$  is  
4 the slope of the pilot signal,  $b_0$  is an initial frequency  
5 shift of the pilot signal,  $Y(t, n)$  is the fast Fourier  
6 transform data,  $t = 0, \dots, N_y - 1$ ,  $n = st + b_0 \pmod{N}$ , and  $n =$   
7  $0, \dots, N-1$ .

1 Claim 25 (original): The method as defined in claim 23  
2 wherein said step of frequency shift accumulating includes  
3 a step of accumulating energy along pilot frequency shifts  
4 of said one or more received pilot tone hopping sequences

5 in accordance with  $J(s, b_0) = \sum_{j=1}^{N_r} J_0(s, b_0 + n_j)$ , where  $s$  is the slope  
6 of the pilot signal,  $b_0$  is an initial frequency shift of the  
7 pilot signal and  $n_j$  are frequency offsets.

1 Claim 26 (original): The method as defined in claim 23  
2 wherein said step of maximum energy detecting includes a  
3 step of estimating said slope and initial frequency shift  
4 of the strongest received pilot tone hopping sequence in  
5 accordance with  $\hat{s}, \hat{b}_0 = \arg \max_{s, b_0} J(s, b_0)$ , where  $\hat{s}$  is the estimate of  
the slope,  $\hat{b}_0$  is the estimate of the initial frequency  
shift, and where the maximum is taken over  
 $s \in S$  and  $b_0 = 0, \dots, N-1$ .

1 Claim 27 (previously presented): A method for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising the steps of:  
5 receiving one or more pilot tone hopping sequences  
6 each including pilot tones, said pilot tones each being  
7 generated at a prescribed frequency and time instants in a  
8 prescribed time-frequency grid; and  
9 in response to said one or more received pilot tone  
10 hopping sequences, detecting the received pilot tone  
11 hopping sequence having maximum energy, said step of  
12 detecting the received pilot tone hopping sequence having  
13 maximum energy including a step of estimating, at a given  
14 time, a frequency shift of the received pilot tone hopping  
15 sequence having maximum energy and estimating a maximum  
16 energy value, and in response to said estimated frequency  
17 shift and said estimated maximum energy value, generating  
18 estimates of an estimated slope and an estimated initial  
19 frequency shift of the strongest received pilot signal.

1 Claim 28 (original): The method as defined in claim 27  
 2 wherein said estimated frequency shift at time  $t$  is  
 3 obtained in accordance with  $n(t) = st + b_0 \pmod{N}$ , where  $s$  is the  
 4 pilot signal slope,  $t$  is a symbol time and  $n(t)$  is a  
 5 frequency shift estimate.

1 Claim 29 (original): The method as defined in claim 28  
 2 wherein said estimated maximum energy value is obtained in  
 3 accordance with  $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$ , where  $E(t)$   
 4 is the maximum energy value,  $Y(t, n)$  is the fast Fourier  
 5 transform data,  $j = 1, \dots, N_p$  and  $n_j$  are frequency offsets.

1 Claim 30 (original): The method as defined in claim 29  
 2 wherein said slope is estimated in accordance with  
 3  $\hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t) - n(t-1) = s\}}$ , where both  $n(t)$  and  $n(t-1)$   
 4 satisfy  $n(t) = st + b_0 \pmod{N}$ .

1 Claim 31 (original): The method as defined in claim 29  
 2 wherein said frequency shift is estimated in accordance  
 3 with  $\hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_p-1} E(t) \mathbf{1}_{\{n(t) = st + b_0\}}$ .

1 Claim 32 (original): The method as defined in claim 27  
 2 wherein said step of maximum energy detecting includes a  
 3 step of finding the time,  $t_0 \in T$ , and slope,  $s_0 \in S$ , such that  
 4 the set of times  $t$  on the line  $n(t) = n(t_0) + s_0(t - t_0)$ , has the  
 5 largest total pilot signal energy.

1 Claim 33 (previously presented): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system including at least two adjacent base  
5 stations, each one of the adjacent base stations  
6 transmitting pilot tones according to one of a plurality of  
7 different pilot tone hopping sequences over at least a  
8 portion of a pilot sequence transmission time period, said  
9 portion including multiple symbol time periods, at least  
10 one of the different pilot tone hopping sequences including  
11 at least two pilot tones per symbol time period which are  
12 separated from one another by at least one tone during said  
13 portion of said pilot sequence transmission time period, in  
14 each of the different pilot tone hopping sequences the  
15 number of pilot tones used in each successive symbol time  
16 period in said portion of said pilot sequence transmission  
17 time period being the same but the tones used in a symbol  
18 time period by any one of the different pilot tone hopping  
19 sequences changing in frequency from one symbol time period  
20 to the next symbol time period by a frequency shift  
21 corresponding to a fixed number of tones, adjacent base  
22 stations using different frequency shifts to generate pilot  
23 tone hopping sequences with different pilot tone slopes  
24 which can be determined from the frequency shift of the  
25 pilot tones used in consecutive symbol time periods, the  
26 apparatus comprising:

27       means for receiving one or more of said different  
28 pilot tone hopping sequences each including pilot tones;  
29 and

30       means, responsive to said one or more received pilot  
31 tone hopping sequences, for generating an accumulated  
32 energy measurement for each individual one of the plurality

33 of different pilot tone hopping sequences having different  
34 pilot tone slopes; and

35 detector means for detecting a received pilot tone  
36 hopping sequence having the maximum accumulated energy over  
37 a period including multiple symbol time periods.

1 Claim 34 (previously presented): The invention as defined  
2 in claim 33 wherein each of said one or more received pilot  
3 tone hopping sequences is a Latin Squares based pilot tone  
4 hopping sequence.

1 Claim 35 (previously presented): The invention as defined  
2 in claim 33 wherein said means for receiving yields a  
3 baseband version of a received signal and further including  
4 means for generating a fast Fourier transform version of  
5 said baseband signal, and wherein said means for detecting  
6 is responsive to said fast Fourier transform version of  
7 said baseband signal for determining a received pilot tone  
8 sequence having the maximum energy.

1 Claim 36 (original): The invention as defined in claim 35  
2 wherein said means for generating said fast Fourier  
3 transform includes means for quantizing the results of said  
4 fast Fourier transform.

1 Claim 37 (original): The invention as defined in claim 35  
2 wherein means for detecting detects a maximum energy.

1 Claim 38 (previously presented): The invention as defined  
2 in claim 37 wherein said means for detecting said maximum  
3 energy includes means for determining a slope and an

4 initial frequency shift of pilot tones in a detected pilot  
5 tone hopping sequence having the maximum energy.

1 Claim 39 (currently amended): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising the steps of:

5 means for receiving one or more pilot tone hopping  
6 sequences each including pilot tones, said pilot tones each  
7 being generated at a prescribed frequency and time instants  
8 in a prescribed time-frequency grid; and

9 means, responsive to said one or more received pilot  
10 tone hopping sequences, for detecting the received pilot  
11 tone hopping sequence having maximum energy, said means for  
12 detecting said maximum energy including means for  
13 accumulating energy along each possible slope and initial  
14 frequency shift of said one or more received pilot tone  
15 hopping sequences, means for generating an accumulated  
16 energy signal, means, responsive to said accumulated energy  
17 signal, for accumulating energy along pilot frequency  
18 shifts of said one or more received pilot tone hopping  
19 sequences, and means, responsive to an output from said  
20 means for frequency shift accumulating, for estimating a  
21 slope and an initial frequency shift of the strongest  
22 received pilot tone hopping sequence as the slope and the  
23 initial frequency shift corresponding to the strongest  
24 accumulated energy.

1 Claim 40 (original): The invention as defined in claim 39  
2 wherein said accumulated energy is represented by the

3 signal  $J_0(s, b_0)$ , where  $J_0(s, b_0) = \sum_{t=0}^{N_N-1} |Y(t, st + b_0 \pmod{N})|^2$ , and  $s$  is

4 the slope of the pilot signal,  $b_0$  is an initial frequency  
5 shift of the pilot signal,  $Y(t, n)$  is the fast Fourier  
6 transform data,  $t = 0, \dots, N_{sy} - 1$ ,  $n = st + b_0 \pmod{N}$ , and  $n =$   
7  $0, \dots, N-1$ .

1 Claim 41 (original): The invention as defined in claim 39  
2 wherein said means for frequency shift accumulating  
3 includes means for accumulating energy along pilot  
4 frequency shifts of said one or more received pilot tone  
5 hopping sequences in accordance with  $J(s, b_0) = \sum_{j=1}^{N_t} J_0(s, b_0 + n_j)$ ,  
6 where  $s$  is the slope of the pilot signal,  $b_0$  is an initial  
7 frequency shift of the pilot signal and  $n_j$  are frequency  
8 offsets.

1 Claim 42 (original): The invention as defined in claim 39  
2 wherein said means for maximum energy detecting includes  
3 means for estimating said slope and initial frequency shift  
4 of the strongest received pilot tone hopping sequence in  
5 accordance with  $\hat{s}, \hat{b}_0 = \arg \max_{s, b_0} J(s, b_0)$ , where  $\hat{s}$  is the estimate of  
6 the slope,  $\hat{b}_0$  is the estimate of the initial frequency  
7 shift, and where the maximum is taken over  
8  $s \in S$  and  $b_0 = 0, \dots, N-1$ .

1 Claim 43 (previously presented): Apparatus for use in a  
2 mobile user unit in an orthogonal frequency division  
3 multiplexing (OFDM) based spread spectrum multiple access  
4 wireless system comprising the steps of:

5 means for receiving one or more pilot tone hopping  
6 sequences each including pilot tones, said pilot tones each  
7 being generated at a prescribed frequency and time instants  
8 in a prescribed time-frequency grid; and

9 means, responsive to said one or more received pilot  
10 tone hopping sequences, for detecting the received pilot  
11 tone hopping sequence having maximum energy, said means for  
12 detecting said maximum energy including means for  
13 estimating at a given time a frequency shift of the  
14 received pilot tone hopping sequence having maximum energy  
15 and for estimating a maximum energy value, and means,  
16 responsive to said estimated frequency shift and said  
17 estimated maximum energy value, for generating estimates of  
18 an estimated slope and an estimated initial frequency shift  
19 of the strongest received pilot signal.

1 Claim 44 (original): The invention as defined in claim 43  
2 wherein said estimated frequency shift at time  $t$  is  
3 obtained in accordance with  $n(t) = st + b_0 \pmod{N}$ , where  $s$  is the  
4 pilot signal slope,  $t$  is a symbol time and  $n(t)$  is a  
5 frequency shift estimate.

1 Claim 45 (original): The invention as defined in claim 44  
2 wherein said estimated maximum energy value is obtained in  
3 accordance with  $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$ , where  $E(t)$   
4 is the maximum energy value,  $Y(t, n)$  is the fast Fourier  
5 transform data,  $j = 1, \dots, N_p$  and  $n_j$  are frequency offsets.

1 Claim 46 (original): The invention as defined in claim 45  
2 wherein said slope is estimated in accordance with

3  $\hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t)-n(t-1)=s\}}$ , where both  $n(t)$  and  $n(t-1)$   
 4 satisfy  
 1  $n(t) = st + b_0 \pmod{N}$ .

1 Claim 47 (original): The invention as defined in claim 45  
 2 wherein said frequency shift is estimated in accordance  
 3 with  $\hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t)=st+b_0\}}$ .

1 Claim 48 (original): The invention as defined in claim 43  
 2 wherein said means for detecting maximum energy includes  
 3 means for finding the time,  $t_0 \in T$ , and slope,  $s_0 \in S$ , such that  
 4 the set of times  $t$  on the line  $n(t) = n(t_0) + s_0(t - t_0)$ , has the  
 5 largest total pilot signal energy.

1 Claim 49 (previously presented): The method of claim 1,  
 2 wherein frequency spacing between pilot tones which occur  
 3 in a symbol time period in each of said plurality of tone  
 4 hopping sequences is fixed and is the same for all of said  
 5 plurality of pilot tone hopping sequences.

1 Claim 50 (previously presented): An orthogonal frequency  
 2 division multiplexing (OFDM) based spread spectrum multiple  
 3 access wireless system comprising:  
 4       at least two adjacent base stations, each one of the  
 5       adjacent base stations transmitting pilot tones according  
 6       to one of a plurality of different pilot tone hopping  
 7       sequences over at least a portion of a pilot sequence  
 8       transmission time period, said portion including multiple  
 9       symbol time periods, at least one of the different pilot

10 tone hopping sequences including at least two pilot tones  
11 per symbol time period which are separated from one another  
12 by at least one tone during said portion of said pilot  
13 sequence transmission time period, in each of the different  
14 pilot tone hopping sequences the number of pilot tones used  
15 in each successive symbol time period in said portion of  
16 said pilot sequence transmission period being the same but  
17 the tones used in a symbol time period by any one of the  
18 different pilot tone hopping sequences changing in  
19 frequency from one symbol time period to the next symbol  
20 time period by a frequency shift corresponding to a fixed  
21 number of tones, adjacent base stations using different  
22 frequency shifts to generate pilot tone hopping sequences  
23 with different pilot tone slopes which can be determined  
24 from the frequency shift of the pilot tones used in  
25 consecutive symbol time periods; and

26 a mobile communications device including:  
27           i) a receiver for receiving one or more of said  
28 plurality of different pilot tone hopping sequences; and  
29           ii) means for determining the pilot tone slope of  
30 a received pilot tone hopping sequence.

1 Claim 51 (previously presented): An orthogonal frequency  
2 division multiplexing (OFDM) based spread spectrum multiple  
3 access wireless communications method, comprising:  
4           at least two adjacent bases stations which transmit  
5 pilot tones according to different ones of a plurality of  
6 different pilot tone hopping sequences over at least a  
7 portion of a pilot sequence transmission time period, said  
8 portion including multiple symbol time periods, at least  
9 one of the different pilot tone hopping sequences including  
10 at least two pilot tones per symbol time period which are

11 separated from one another by at least one tone during said  
12 portion of said pilot sequence transmission time period, in  
13 each of the different pilot tone hopping sequences the  
14 number of pilot tones used in each successive symbol time  
15 period in said portion of said pilot sequence transmission  
16 period being the same but the tones used in a symbol time  
17 period by any one of the different pilot tone hopping  
18 sequences changing in frequency from one symbol time period  
19 to the next symbol time period by a frequency shift  
20 corresponding to a fixed number of tones, each of the  
21 adjacent base stations using different frequency shifts to  
22 generate the transmitted pilot tone hopping sequences  
23 resulting in different pilot tone slopes which can be  
24 determined from the frequency shift of the pilot tones  
25 transmitted in consecutive symbol time periods.

1 Claim 52 (previously presented): The method of claim 51,  
2 wherein frequency spacing between pilot tones which occur  
3 in a symbol time period in each of said plurality of tone  
4 hopping sequences is fixed and is the same for all of said  
5 plurality of pilot tone hopping sequences.